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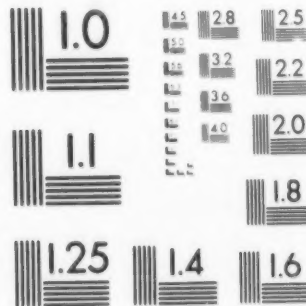
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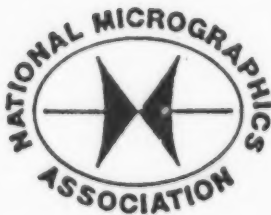
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RESEARCH REPORT

LONG-TERM OUTLOOK ON THE DEMAND
FOR MORTGAGES IN CANADA
SUMMARY REPORT

**HOUSING
AFFORDABILITY
AND FINANCE
SERIES**



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**Long-Term Outlook
on the Demand for Mortgages in Canada
*Summary Report***

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December 2000

Report prepared for
Canada Mortgage and Housing Corporation¹
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I. Introduction

With the decrease in the fertility rate and the aging of the Canadian population, new housing needs are declining. Recently, Fortin and Leclerc (1999) concluded that housing demand will continue to rise over the coming decades, under plausible assumptions of economic and demographic growth. However, it is more difficult to identify the impact of demographic changes on the residential mortgage lending market. In fact, young households are the ones who most need mortgage financing, as older households have sufficient wealth to cover a significant portion of their home purchases without borrowing. This research project is aimed at defining plausible trends in the demand for mortgage credit in Canada over the next 25 years.

To understand the determinants of the demand for mortgage credit, we reviewed the theoretical literature on this subject. This literature studies the effect of mortgage lending costs in comparison with the costs of financing using one's own equity, the role of restrictions limiting the amount borrowed and, finally, the various interactions between investment and borrowing decisions. We present the results of the principal empirical studies. These studies examine mainly the relationship between the average value of mortgage debt and the price of housing. Supply of funds does not play a significant role in the loans outstanding trend as interest rates are not subject to any restrictions. Savings are generally sufficiently abundant to meet financing needs. We subsequently examine a few mortgage market indicators and review a number of articles that are representative of the recommendations of financial planners concerning mortgage debt.

The approach that we follow decomposes the mortgage loans outstanding trend by using an identity. The change in mortgage debt outstanding (D) results from two opposing forces. On the one hand, new mortgage financing contributes to raising the amount outstanding. This new authorized financing (A) is equal by definition to the product of two elements, namely, the average value of new mortgage loans (V) and the number of new mortgage loans (N), that is, $A = V \times N$. On the other hand, the amount outstanding decreases when loans in force are repaid (R). The overview of the market trend and the subsequent empirical analysis are therefore focused on the study of four indicators that constitute the identity (1): $\Delta D \equiv V \times N - R$, where Δ represents the change in a variable over a period of time.

After examining the trends of these four elements, we estimate a statistical model allowing us to understand which economic and demographic variables influence these elements. We then highlight the role played by five variables: the average real household income, the interest rate on residential mortgages, the inflation rate, the average real price of homes and the changes in the Canadian population in two age segments: 25 to 34 years old and 25 to 54 years old.

In the last section, we use the relationships identified in the statistical model to establish conditional projections of the four elements of the identity. These projections are based on the probable changes in average household income and on the latest demographic scenarios produced by Statistics Canada.

2. Overview of Theoretical and Empirical Studies on the Demand for Residential Mortgages

There are few theoretical studies and, until the early 1990s, they were essentially limited to the Ranney (1981) model. This model provides a comprehensive analysis of housing demand in an environment with no uncertainty when households face borrowing restrictions. The model assumes that households want to become homeowners. To this end, they may combine two methods of financing, namely, their own equity and mortgage loans. Two basic assumptions are made: loans are more costly than financing using one's own equity and loans cannot exceed a maximum amount ("the borrowing constraint").

With this relatively simple framework, Ranney obtained some very interesting results. First of all, households have an incentive to borrow as little as possible, as borrowing is more costly than equity financing. Yet, Ranney shows that, at the time of the initial purchase, less wealthy households borrow up to their borrowing limit. This means that the ratio between the loan and the value of the home (LTV) reaches the maximum permitted. This happens because borrowing is the inescapable route to accessing homeownership sooner. If households decided to borrow little, they would either have to buy a home that would be too small or postpone their purchase and continue renting; they reject these options as they want to benefit from the advantages of homeownership to the fullest of their resources.

Once the initial borrowing decision is explained, the accumulation of savings by households will bring about a progressive change in their decisions towards the eventual full repayment of their loan. In a first phase following the purchase, households want to use the additional savings to become the owners of a home with a higher value, while maintaining the LTV ratio at a maximum level. We pointed out that this behaviour, indicated by the Ranney model, can be inhibited in the short term, however, if the cost of real estate transactions is high. When their housing needs are sufficiently met, households enter a next phase where they use additional savings to progressively reduce their mortgage debt. Finally, when the debt is fully repaid, and only then, households will start accumulating financial assets. An important prediction of this model is that the

accumulation of financial assets begins only after the mortgage is fully repaid.

According to this model, the aging of the population should result in a progressive decrease in the demand for mortgage credit. Jones (1993, 1995), however, questions the extent to which the Ranney model results are valid. He notes that a large proportion of households hold financial assets even while their mortgage has not been fully repaid, which is inconsistent with the Ranney model. He attempts to develop a theoretical framework in which households borrow to invest in financial assets.

We concluded, however, that Jones' theoretical framework omits some important considerations and we preferred the explanations of Brueckner (1994, 1997). Brueckner introduces uncertainty into the analysis, which enables him to explain why it may be optimal to simultaneously hold financial assets and mortgage debt. Brueckner first points out that, according to the theory of portfolio choice, the optimal portfolio, or market portfolio, has the same mix for all households. He further notes that the demand for housing responds to a dual motive. Housing effectively constitutes both an asset in the portfolio and a durable good providing consumable services. The demand for housing for consumption purposes on the part of young households whose wealth is low exceeds the value of the home in the optimal portfolio. In such a situation, the quantity of housing effectively owned results from a compromise between consumer needs and the impact of this home on the portfolio risk. In addition, in order to limit the risk, the household then holds very few other risky assets in its portfolio.

As a household ages, its wealth increases. Since the demand for housing for consumption purposes depends on the average income that a household anticipates over its lifetime, it varies little with age. On the other hand, the demand for housing for investment purposes increases with wealth. Once it approaches the demand for consumption purposes, a household rebalances its portfolio so that its composition is closer to that of the market portfolio. In doing so, it gradually increases its share of risky assets even before the mortgage debt is fully paid off.

Eventually, the demand for investment purposes may well exceed that for consumption purposes. The portfolio is then a market portfolio and a household will have real estate assets, which it will then rent to others. It will have completely paid off its mortgage debt beforehand.

The main conclusion drawn from the theory is the following. The models which assume known rates of return conclude that households want to either maximize or minimize the mortgage debt. Hence one should not observe situations where households have financial assets when the mortgage debt has not been completely paid off. Because a large number of households find themselves in such a situation, we must look to the portfolio choice models with random rates of return to explain this. A robust prediction of the different models is, however, that the demand for mortgages should decrease as the household's wealth increases. As wealth increases with age, aging should lead to a drop in the demand for mortgage credit.

Lastly, our literature review highlights a fairly significant omission. Returns on investments are dealt with in the theory, as if they were taxable. However, an increase in registered retirement savings plan contribution limits gives a higher percentage of Canadian households the possibility of putting money in funds with tax-sheltered returns. Moreover, new opportunities offered under the Home Buyers' Plan were not included in the theoretical studies.

The empirical studies that we identified differ on several levels but they all share one common characteristic: they use cross-section data to explain the sources of variation between households. None of these studies looks at the mortgage lending market using time series. Therefore, we will be navigating through uncharted waters when developing our empirical model. Yet we will not be starting off empty-handed since a comparative analysis of the results reveals three main principles.

The first follows from theoretical observations. In the context of random returns, part of the mortgage debt is the object of arbitrage with investments. Ioannides (1989), Manchester and Poterba (1989), Jones (1993, 1995) and Fratanoni (1998) all find a link between the mortgage debt and the amount of risky assets. Portfolio choices are therefore influenced by the presence of housing and mortgage debt. We see here a strong indication in favour of the predictions in Brueckner's model (1997).

Another element, identified by Ling and McGill (1998) and also by Ioannides (1989) is that the proximity of a residential transaction has a very significant effect on the LTV ratio and the composition of the rest of the portfolio. In Canada, arbitrage should especially become relevant when the household has unused Registered Retirement Savings Plan (RRSP) contribution room because they are then able to save and defer taxes on the contributions and investment returns until withdrawals are made from the Plan, usually at retirement. The empirical study will attempt to confirm the importance of this.

The third important element is that an increase in housing value goes hand in hand with an increase of mortgage debt. According to studies performed by Jones (1993, 1995) and by Ling and McGill (1998), a \$1000 increase in housing value increases the mortgage debt by a little over \$500 in the United States. According to Ling and McGill, interest deductibility would, however, be a major factor in the decision to finance a home using loans of 50% at the margin. Jones indirectly confirms this interpretation. In fact, Jones finds that in Canada—where mortgage interest is not deductible—an identical price increase affects the demand for mortgage only about one third as much and the mortgage would increase by only \$140.

Existing empirical studies have sought, in particular, to explain the LTV ratio variations between different households, but the explanatory power of these studies is rather low. None of the identified studies have attempted to study the mortgage lending market from a general perspective.

3. Mortgage vs RRSP: When Financial Advice Gets Confusing

In contrast to the relative scarcity of theoretical studies on the demand for mortgage loans, an abundance of advice is available in this field. There is general agreement on some matters: for example, that a household that has deposits with taxable interest should cash in those deposits in order to expedite repayment of its mortgage. On the other hand, making RRSP contributions as opposed to faster repayment of the mortgage debt is subject to controversy. This issue became more popular with the increase in RRSP contribution limits in the 1990s and the option of carrying forward unused contribution room. (Akyeampong, 2000, p. 9)

This new tax environment has led some financial institutions to offer bridge loans, which make it possible to make RRSP contributions equal to any unused contribution room. From 1991 to 1998, unused RRSP contribution room represented a potential market of 150 billion dollars. (Chiasson, 1999, p. 39). The strategy that banks propose is currently the following. A household that has some money available should contribute to its RRSP and use the resulting income tax reduction to pay back part of its mortgage loan. However, recommendations from financial institutions should be given careful consideration because they find themselves in a conflict of interest situation. If they can lend money to a household in order to contribute to its RRSP, or convince a household that it is better not to pay off the mortgage in order to contribute to the RRSP they are offering, the banks come out winners on two fronts: they reap the profits from the loan and the RRSP.

Nevertheless, many unbiased specialists agree with these recommendations. Let us take for example, Daniel Lachapelle, of the Raymond Chabot Martin Paré accounting firm, quoted in Girard (1990); Lantaigne (1997) of the Caron Bélanger Ernst & Young accounting firm; Joanne Thomas Yaccato (1997) and Levine (1999). The latter goes even further. Using a part of one's income for consumption without having taken advantage of the totality of annual contribution room represents consumption with very high opportunity costs. Moreover, even if Thomas Yaccato (1997) favours RRSPs, she points out that the right answer varies

with income, because the tax savings offered by RRSPs depend on income.

The calculations supporting this advice are difficult to explain because the assumptions are often not made explicit. When we try to dissect them, we generally find the following points. First of all, the advantage of an RRSP contribution is sometimes based on the assumption that its rate of return is higher than the mortgage interest rate. In such cases, an RRSP is undoubtedly more advantageous. However, there is no explanation as to which types of investments have such high rates of return. In practice, only mutual funds have such potential. Unfortunately, the expected return inherently brings with it an increased risk, which the analyses do not reveal. If a household opts for investments with fixed rates of return, such as term deposits or guaranteed investment certificates (GICs), the rate of return is lower than the mortgage interest rate.

Other analysts question the calculations when an RRSP appears to have an advantage over the repayment of a mortgage loan, despite the fact that its rate of return is lower. The basic problem would be the fact that tax specialists consider the calculations strictly from a tax savings perspective and forget to take into account certain elements. For example, they fail to consider the drop in mortgage payments afforded by paying back part of the mortgage with an RRSP. When all elements are considered, the only situation where investing in an RRSP is financially more advantageous than faster repayment of the mortgage loan is when the rate of return on the RRSP is higher than the mortgage interest rate. Other stakeholders in the financial community also harbour reservations with regard to investing in RRSPs, suggesting that other investment strategies may be more profitable, particularly for the more serious speculators. [Grammond (1997) and Cohen cited in Anonymous (1999)].

Furthermore, some broach the interesting question raised by the Home Buyers' Plan: Is it advantageous to borrow money from one's RRSP to purchase a home? According to the provisions of this plan, a first-time home buyer can withdraw up to a maximum of \$20,000 from his/her RRSP without

being subject to tax burdens usually associated with such withdrawal. However, the home buyer must pay back his/her RRSP in its entirety in equal annual payments over a maximum of 15 years. (Frenken, 1998, 41). As shown by Frenken, in the first six years following the plan's implementation in 1992, over 650,000 Canadians withdrew \$6.2 billion from their RRSPs to finance the purchase or construction of a home.

For François J. Beauregard, a financial planner and vice-president of the individual client services division at Merrill Lynch, "the Home Buyers' Plan is without a doubt a good way to improve one's quality of life, but certainly not one's financial situation" [translation]. (Thérout, 1999) As for Christine Zazal, senior manager of the residential mortgage division at the Royal Bank, by withdrawing a portion of money from one's RRSP, a household loses the returns on that amount during the repayment term.

(DeMont, 1997) Furthermore, the Canadian experience shows that one third of people required to make repayments failed to do so. These unpaid amounts are taxed at the marginal tax rates of such participants in the Home Buyers' Plan and cannot be made "in subsequent years as RRSP repayments as there can be no catch-up of overdue payments" [translation]. (Frenken, 1998, 44) This concern over lost RRSP performance once again brings to light a certain nearsightedness. We forget that a household that uses the Home Buyers' Plan will have less to pay on its mortgage loan, which opens up the possibility for additional savings.

This review of financial advice reveals that there are varying opinions, which results from a lack of thorough analyses, but may also be due to the fact that most advisers also sell financial services. Their advice may therefore be influenced by their desire to capitalize on those services.

4. Canadian residential mortgage market trends

The residential mortgage market underwent major changes in the late 1960s. Following legislative changes, chartered banks received the right to grant ordinary mortgage loans in 1967. Furthermore, the 6% interest rate ceiling was changed, which led to the free determination of interest rates on the market. These two modifications together increased the supply of mortgage loans considerably.

The real estate boom in the 1970s was largely responsible, for its part, for the strong increase in the demand for mortgage loans (see Figure 1). The total amount of debts outstanding went from \$16 billion in 1969 to \$87 billion ten years later. Even if this increase was inflated by an upturn in inflation during that same period, the real loans outstanding still increased very quickly. In 1986 constant dollars, the loan value went from \$54 billion in 1969 to \$143 billion in 1979, an average annual increase of 10%. The violent recession of the early 1980s—accompanied by a strong increase in interest rates—put a sudden stop to growth in the mortgage loan market, whose real value dropped to just \$117 billion in 1982, an 18% setback in three years. The 1983 recovery and the return of interest rates back to more comfortable levels provided the foundation for a second surge in the mortgage lending market, where nominal loans outstanding reached \$225 billion in 1989 (197 billion in 1986 constant dollars). The recession of the early 1990s

Figure 1: Residential Mortgage Loans Outstanding in Canada

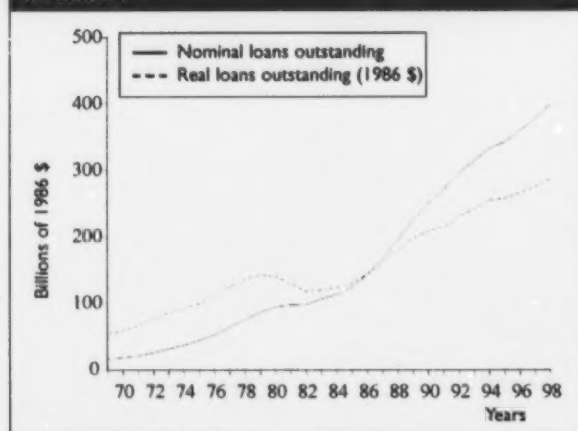
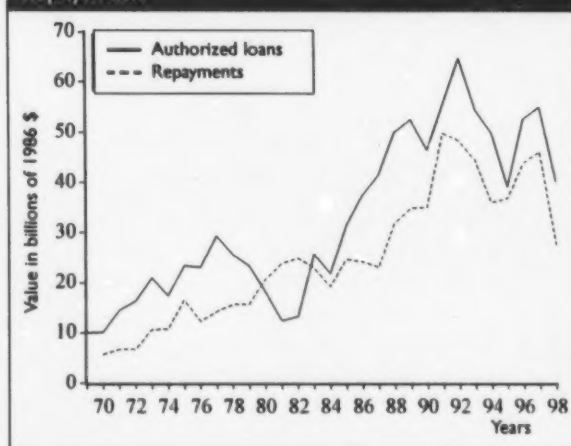


Figure 2: Real Value of Authorized Loans and Repayments



helped slow down the market. However, contrary to what had occurred ten years earlier, the real value of loans outstanding continued to increase. The modest recovery was such that real household incomes stagnated. This contributed to the continued low growth of nominal and real mortgage loans outstanding throughout the 1990s. In late 1998, the nominal debts outstanding neared \$400 billion, for a real value of 287 billion in 1986 constant dollars. In 30 years, real mortgage debt outstanding therefore increased more than fivefold.

Figure 2 shows the real value of authorized loans and repayments in 1986 constant dollars. Between 1969 and 1977, the real value of authorized loans tripled, going from \$10 billion to \$29 billion before dropping sharply to just \$12 billion in 1981. The loans then underwent a sharp increase, recording a high in 1992 of \$65 billion before trending generally downward to \$52 billion in 1998. Debt retirements posted a comparable trend to that for authorized loans. Short-term movements for both series are generally similar, with the exception of the 1980-82 period, when exceptionally high interest rates induced a major change in debt retirement. We believe the similarity in short-term changes can be explained as follows. When the value of real estate transactions goes up, this leads to an increase in the number of authorized housing financing loans. At

the same time however, more mortgage loans must be paid off.

We have seen that because of borrowing restrictions, the average value of new loans should theoretically closely follow that of housing. Figure 3 compares the real value (in 1986 constant dollars) of newly authorized mortgage loans to that of the average selling price of Multiple Listing Service (MLS) homes. The real value changes in authorized loans closely match those of housing prices. Both series increased sharply between 1970 and 1975, dropped more than 20% between 1980 and 1983 and recovered very quickly between 1985 and 1989. The real value of housing peaked at \$128,098, while the real value of loans was \$65,946. Between 1990 and 1995, both series underwent an irregular evolution accompanied by a slow, moderate drop. Also, between 1996 and 1998, the average loan value increased fairly quickly whereas housing prices dropped slightly. Therefore the LTV purchase ratio, which generally ranged between 54% and 60% since the late 1960s, rose quickly in the next three years to an unprecedented 62% in 1998.

The number of authorized loans is presented in Figure 4. Since these loans are most often granted for the purchase of a home, it is plausible to assume a link between the number of loans and the number of real estate transactions. Thus, we also present the

Figure 3: Real Average Value of New Loans and Real Price of Homes

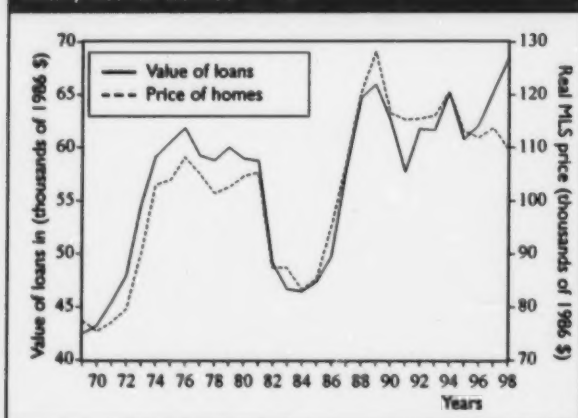
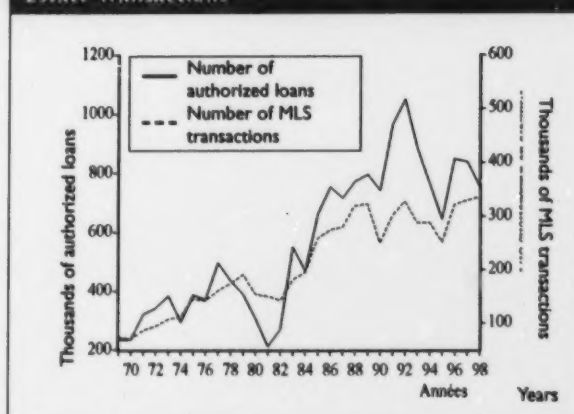


Figure 4: Number of Mortgage Loans and Real Estate Transactions



number of MLS-registered transactions. In fact, although the number of authorized loans each year is significantly higher than the number of MLS real estate transactions, we see a great similarity in the short-term changes of the two series. The correlation between the annual growth rates of the two series is 0.67.² The number of loans dropped by more than 50% between 1978 and 1981, owing to the recession and hike in interest rates.

In summary, activity on the mortgage lending market greatly reflects real estate activity. There is a strong correlation between the value of authorized mortgage financing and that of real estate transactions. The average value and number of loans are influenced by the average home price, the number of real estate transactions and macroeconomic conditions. The analysis also demonstrated that the value of repayments evolves simultaneously with that of authorized loans, which is explained by the fact that the financing granted to the buyer is used to repay the seller's mortgage debt. We also noticed that in the early 1980s, repayments increased while authorized loans decreased, as a result of a drop in average home value and the number of mortgage loans. The next section shows how the potential determinants of mortgage financing activity have evolved.

² If we limit ourselves only to loans granted for the financing of new homes, loans which recently represented approximately 13% of the total number of authorized loans, we find that their number changes in parallel with the number of housing starts.

5. Estimating the demand for mortgages

A breakdown of the identity (1) introduces four elements, only three of which are independent. Thus, we estimated the determinants of three elements, that is, one equation for real loans outstanding, one for the number of new loans and one for their average value. This makes it possible to calculate the predicted value of repayments and of authorized loans. The final model used can be written as follows:

$$\Delta V_t = \gamma_1 + \gamma_2 \Delta Y_t + \gamma_3 \Delta P_t + \varepsilon_t$$

Average value of new loans equation

$$\Delta N_t = \Psi_1 + \Psi_2 \Delta R_t + \Psi_3 \Delta POP_t + \Psi_4 \Delta N_{t-1} + v_t$$

Number of new loans equation

$$\Delta D_t = \beta_1 + \beta_2 \Delta D_{t-1} + \beta_3 \Delta R_t + \beta_4 \Delta \pi_t + \beta_5 \Delta P_t + \beta_6 \Delta Y_t + u_t$$

Debts outstanding equation

The meaning of the symbols is provided in Table 1.

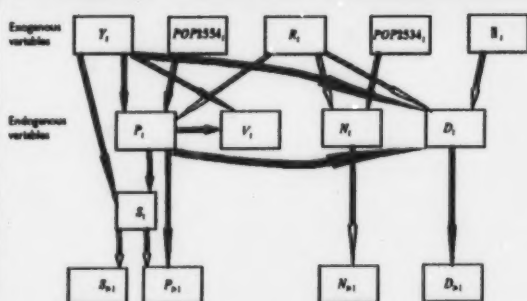
The growth rate of the average value of new mortgage loans is a function of the growth in housing prices and real income per adult. The growth in the number of authorized loans depends on variations in the nominal interest rate, the growth rate of the population in the age group 25 to 34 years of age and the growth in the number of loans made the previous year. Finally, the growth of real mortgage debt outstanding is a function of its lagged growth, variations in the mortgage interest rate and rate of inflation, as well as the logarithmic variation in real housing prices and real income per adult. The inclusion of the real price of housing is required but presents a potential problem because this price is itself conditional upon certain other variables. In a previous study, (Fortin and Leclerc, 1999), a model was developed which explains both changes in real MLS prices and housing stocks (S_t). The variables which explain P_t are P_{t-1} , Y_t , R_t and S_{t-1} . The value predicted by this model solves the

Table 1: Symbol Legend

Meaning	Symbol
Logarithm of the average value of new loans (in 1986 dollars)	V_t
Logarithm of the number of new loans	N_t
Logarithm of the total mortgage debt outstanding (in 1986 dollars)	D_t
Logarithm of the gross domestic product per adult (in 1986 dollars)	Y_t
Nominal interest rate on 5-year mortgages	R_t
Logarithm of the average MLS housing price (in 1986 dollars)	P_t
Logarithm of the population aged 25 to 34 years old	POP_t
Annual growth rate in the Consumer Price Index	π_t

potential problem. The logical structure of the complete model is described in Figure 5. The black arrows indicate the positive effect of a variable whereas the white arrows indicate a variable with a negative effect.

Figure 5: Model Structure



Some of the results merit particular emphasis. First of all, the real value of new loans increases by 0.84% when the real price of housing increases by 1%. Real income affects the value of mortgage loans in two ways. First, it has a direct effect such that a 1% increase in income raises the debt by 0.56%. The indirect effect, arising through the effect of income on the price of housing, which, in turn, increases the debt, is more significant since it increases the average value of new loans by 0.70%. The total impact of the 1% increase in real income, the sum of direct and indirect effects, is therefore 1.26%. Finally, the nominal interest rate has a negative effect on housing values (Fortin and Leclerc, 1999) which will indirectly reduce the real debt. This impact is fairly significant since a 1-percentage-point increase in 5-year mortgage loan rates reduces the average value of mortgage debt by 1%.

The number of new loans is influenced only by two variables. The more significant is the interest rate, the negative effect of which is very pronounced and highly statistically significant. Thus, an increase of only 1 percentage point in the nominal interest rate reduces the number of new loans authorized by 15%. We believe this high sensitivity of the number of loans to the nominal interest rate is explained by the fact that a 1-percentage-point increase in interest rates results in a relatively large percentage increase in the monthly payments required to amortize the mortgage.³ The other variable which influences the growth in the number of loans is the growth rate in the 25 to 34-year old age group. A 1% increase in population growth increases the number of loans authorized by 4.3%. This high sensitivity, which is, at first glance, surprising, is explained by the fact that the number of individuals in a given age group must increase by a high percentage in order to increase the population growth by 1%. Finally, the equation includes a lagged dependent variable resulting in the long-term effect being weaker than the immediate reaction.

The real mortgage debt outstanding reacts to a greater number of variables. An increase of 1 percentage point in nominal interest rates decreases the debt outstanding by 1.56%, whereas a 1% increase in real MLS prices increases it by 0.26%. An increase in the real GDP results in a slight decrease in real debt outstanding whereas a 1-percentage-point increase in inflation reduces outstanding debt by 0.73%. Finally, the effect of the lagged change in debt outstanding is 0.81. This coefficient indicates that the immediate reaction in the debt outstanding leads to relatively strong subsequent changes. Thus, the effects previously described are only the immediate reactions of the debt outstanding to the shock. The final, long-term adjustment of the debt outstanding is much higher than the immediate effects which have just been described.

³ This point can be illustrated by considering the effect of an interest rate increase from 7% to 8% on the monthly expenses of a \$100,000 mortgage with a 25-year amortization plan. Monthly payments increase by 9.2%, from \$707 to \$772.

6. Canadian residential mortgage market projections

6.1 Model structure

The projections are based on the model estimated in the previous section. In order to obtain projections of endogenous variables, the model must use projected values of the exogenous variables. Various demographic growth scenarios are published by Statistics Canada. These provide the basis for projecting the population growth in the two age segments in the model. It is also easy enough to imagine plausible scenarios for real GDP, interest and inflation rates. The projection of real MLS prices is obtained by re-estimating the model from Fortin and Leclerc (1999). By combining the two equations of this model with the three equations previously developed, a structural model is obtained which uses five exogenous variables to project changes in the five endogenous variables according to the logical structure described in Figure 5. The model's dynamic structure is also outlined in this same figure. Note the negative effect of the housing stock and the positive effect of the price of housing on the price in the following period. In the same way, the number of mortgage loans and debt outstanding has a positive effect on their value in the subsequent period. Finally, note that the equations which determine the variables V_t , N_t and D_t are estimated by difference. Consequently, the value of these variables until 2026 is calculated recursively from their previous value, beginning in 1999, the year following the last historic year, which is 1998

6.2 Different demographic and economic scenarios

In this section we will present scenarios for these variables. Economic forecasts are based on the current situation and on a continuation of past trends. Nominal interest rates on 5-year mortgages remain stable at 7.5%, and the inflation rate stays at 2%.

Two scenarios were employed for changes in the real GDP per adult. The low-growth scenario has a stable growth rate of 1% per year, continuing the trend of the past 20 years. In the medium-growth scenario, the rate is higher at 1.65%, which is the average growth rate since 1960. A sensitivity analysis will show that how the results change when these

hypotheses are modified. The difference in growth rates between these two scenarios has a significant cumulative effect. Thus, while the real income per adult in 1986 dollars was \$24,474 in 1999, it varies between \$36,656 and \$43,556 in 2026, for a difference of 19% between the two scenarios.

The demographic projections to 2026 are based on three scenarios of low, medium and high population growth, established by Statistics Canada in 1999. The projections differ in their hypotheses on fertility, life expectancy, immigration, emigration, and internal migration. Overall, these population scenarios issued by Statistics Canada suggest that the population will continue to grow during the period. Thus, the total population in 2026 varies between 33.7 million inhabitants (low growth) and 39.2 million (high growth), the difference between these two figures being 16%. In relation to the current population of 30.5 million inhabitants, population growth fluctuates between 10.5% and 28.5%.

However, because population growth will be concentrated in the older age segments, population growth in the 25 to 34 year age group will be much lower and may even decrease, according to the low-growth scenario. The population of this age group is projected to go from its current level of 4.44 million to a level of between 4.27 million (low-growth scenario) and 4.82 million (high-growth scenario) in 2026, a difference of 13% between the two extremes. In all the cases, the population in this age group initially decreases before it increases, with the time of renewed growth varying according to the scenario. Population forecasts for the 25- to 54- year age group presents a very different profile. Whereas growth is currently approximately 1% per year, it is projected first to decrease rapidly between 2000 and 2002 and then to continue to decrease progressively until 2019. At that point, it will be between -0.5% (low growth) and 0% (high growth) before experiencing a mild increase which will push the growth rate up slightly until 2023. These various scenarios forecast that this population will go from 13.94 million in 1999 to a level which will vary between 13.46 million (low growth) and 15.21 million (high growth) in 2026, which is a difference of 13% between the two extremes.

The combination of these two growth hypotheses and the three demographic hypotheses provide six scenarios for change in the Canadian residential mortgage market (Table 2). For each variable, we have thus six possible paths of change which the variable may follow.

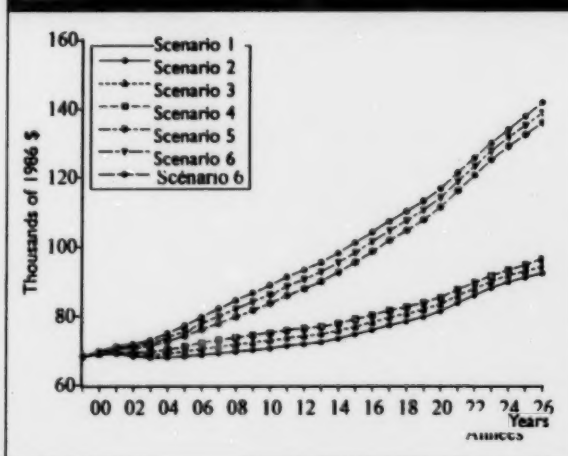
6.3 Market indicator projections

The six scenarios of the average real value of new mortgage loans, shown in Figure 6, follow two different trends. The scenarios associated with the strongest GDP growth place the average real value of new mortgage loans between \$136,000 and \$141,900, as compared to \$68,300 currently, which is an increase of slightly more than 100%. Scenarios associated with low GDP growth place the range of average value in 2026 at a much lower level, between \$92,400 and \$96,400 in 2026, for an increase of only 38%. Clearly, change in real income dictates change in loan values, since this variable is the major determinant of real housing prices over the long term. Even if our model suggests regular but slow increases in the LTV ratio, which could vary between 63.6% and 66.7% in 2026, only a strong increase in average housing values could result in a substantial increase in average loan values.

The number of new loans is sensitive to population growth in the 25- to 34-year age group but does not react to real income. There are therefore only three scenarios for the number of loans, shown in Figure 7. All three scenarios suggest a reduction in the number of new loans, the lowest projection being associated with the weakest population

growth. After an initial rapid drop in the number of loans, demographic increases in young households from 2004 onward slows down or even temporarily interrupts the decline. However, the decline accelerates again from 2020 onward, as a result of decreases in the young population beginning at that date. In 2026, the number of new loans is projected to lie between a minimum of 300,000 and a maximum of 450,000.

Figure 6: Projected Average Value of New Mortgage Loans



By multiplying the number of new loans by their average value, projections of the total value of new authorized loans are obtained (see Figure 8). The six scenarios project a reduction in the value of new authorized loans between 1999 and 2003 and between 2021 and 2026. However they differ rather markedly between 2004 and 2021, leading to values

Table 2: Description of scenarios

$\Delta\%$ GDP/Adult	Demographic Growth	Scenario Name	Scenario Number
1.00 %	Low	Low-low	1
1.00 %	Medium	Low-medium	2
1.00 %	High	Low-high	3
1.65 %	Low	Medium-low	4
1.65 %	Medium	Medium-Medium	5
1.65 %	High	Medium-High	6

Figure 7: Projected Number of New Mortgage Loans

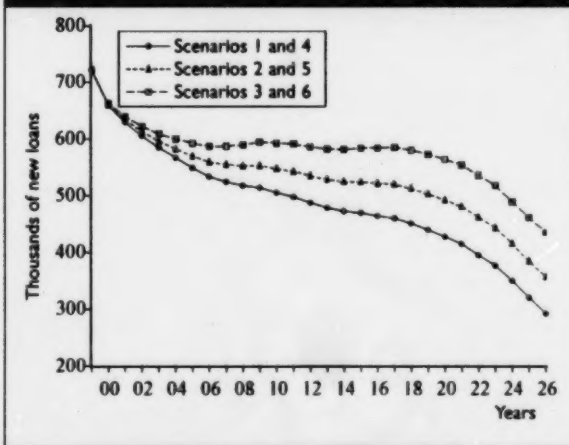


Figure 9: Projected Mortgage Loans Outstanding

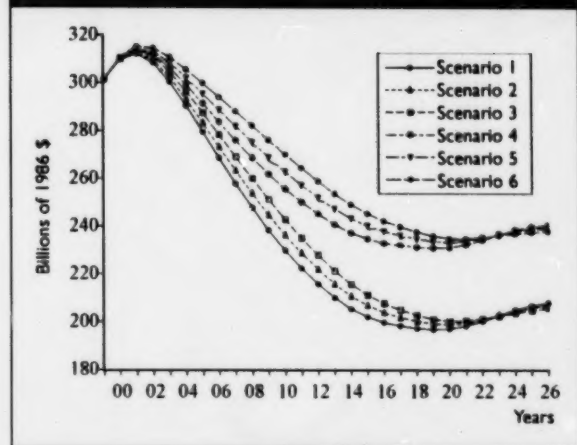


Figure 8: Projected Total Value of New Loans Authorized

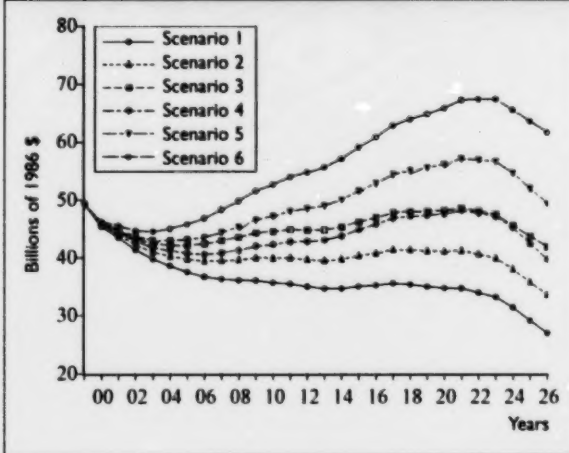
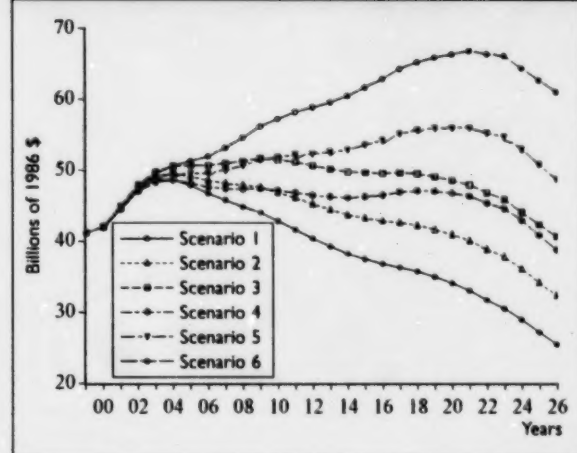


Figure 10: Projected Total Value of Loan Repayments



in 2026 as low as \$27 billion or as high as \$62 billion. In the highest case, the projected value is higher than the real total value of loans granted at the end of the 70s.

The projected debt outstanding is shown in Figure 9. The six scenarios project that the real total debt outstanding will increase in 2000 and 2001 and then begin to decrease until 2019 or 2020 before experiencing a slight increase. In 2026, the debt outstanding in the first three scenarios is at about \$205 billion, compared to approximately \$240 billion in the other three. Low demographic growth scenarios project a greater decrease between

2003 and 2016 but the debt outstanding in these low demographic growth scenarios increases more strongly, so that in 2023 the forecast debt outstanding is virtually insensitive to population growth forecasts.

Finally, Figure 10 shows the repayment projections. These increase significantly until 2004, going from close to \$42 billion in 1999 to approximately \$49 billion. Then, Scenario 1 projects a continuous decrease to less than \$25 billion in 2026. On the other hand, Scenario 6 projects that payments will increase until 2021, when they will be close to \$67 billion. They then remain at this level until

2023 before beginning to decline. The other scenarios all suggest that payments will eventually decrease. The value of payments in Scenario 3 is higher than in Scenario 4, which is a result of the strong correlation between loans authorized and payments. This explains why Scenario 4 projects a higher debt outstanding than Scenario 3 in spite of the fact that there will be fewer loans authorized.

6.4 Sensitivity analysis

The six scenarios enable us to identify which of the projected results are sensitive to changes in income or population growth rates. The significance of income increases in changes in mortgage demand can be seen. However, these six scenarios are all based on the same interest rate and inflation hypotheses. We have therefore studied how changes in these hypotheses affect these projections. This sensitivity analysis reveals that interest rates are the greatest source of uncertainty since they have a

strong effect on the number of loans. Thus, a permanent 1-percentage-point increase in interest rates causes an immediate 14% decrease in the number of mortgage loans and a permanent decrease of 11%. Since the average value of mortgage loans decreases by 1% in the first year and 2% over the long term, the permanent effect on loans authorized reaches 13%. In concrete terms, a gap of 1 percentage point in interest rates translates into a variation of approximately 40,000 new loans in 2026. Interest rates were found to be the major source of uncertainty, due to their variability.

Inflation has an impact on payments, and therefore, on debt outstanding. The potential effect however is clearly weaker than the effect of interest rates, since this is only a partial effect in which the nominal interest rate does not react to inflation rates. Since interest rates tend to change with inflation rates, changes in inflation rates affect payments as much as interest rates do.

7. Conclusion

Our empirical analysis is the first study of the mortgage market using aggregate time series data. It represents an addition to the existing studies which have, in general, concentrated on variations in the LTV ratio of different households. Among the most interesting results, we note first of all that in Canada, as predicted by the theoretical forecasts, the value of new loans follows housing values very closely. We then showed that the number of new loans reacts strongly to variation in interest rates. Our results suggest that a permanent, 1-percentage-point increase in interest rates reduces the number of new mortgage loans by almost 14% in the first year. Since this shock reduces the average loan value, this also leads to a rapid reduction in loan debt outstanding.

By combining the empirical results with projections of population, income, mortgage interest rates and inflation rates, we projected various scenarios for the Canadian residential mortgage market up to 2026. The main result of these projections is that the phase of rapid market growth is expected to end in 2002. Following that, all scenarios suggest that the number of new loans as well as the total mortgage debt outstanding, in constant dollars, will experience a substantial decrease. This decrease will be less marked if a more rapid demographic growth in the 25- to 34-year age group coincides with favourable economic conditions.

We project that the number of new loans will suffer a significant reduction beginning in 2003, coming down to between 300,000 and 450,000 annually, compared to the current level of approximately 700,000. In 2026, it will thus reach a level of activity similar to that of the early 80s. However, the average value of new loans over the long term follows a trend dictated by average real household income. Thus, in the scenarios with rapid income growth, the average value of new loans authorized

increases sharply to approximately \$140,000 (in 1986 dollars) in 2026, compared to \$68,000 today. On the other hand, if the GDP grows more slowly, the average loan value would more likely be around \$94,000. The uncertainty with respect to the changes in average loan values has repercussions on the total value of new authorized loans. In 2026, these fall within a very large range, between \$27 billion and \$62 billion, compared to the current figure of \$52 billion. However, due to the effect of repayments, the uncertainty with respect to the total outstanding loan debt is relatively small, fluctuating between \$205 billion and \$240 billion in 2026, which is a decrease of between 20% and 30%.

The explanation for certain behaviour is still inadequate at the theoretical level. Even though the changes in demand for mortgage credit at the time of purchase is well understood, it is more difficult to understand the motives for subsequent financial household decisions. The theory suggests that as they mature, households are motivated to pay off their mortgages. However, a desire for portfolio diversification may lead them to maintain a mortgage balance, especially if it is possible to make more profitable investments where returns are tax sheltered.

However, we have not determined that there is a significant connection between total mortgage debt and certain measures of stock yields. This leads us to believe that households engage in little arbitrage between their mortgage debt and stock portfolio. In addition, the provisions introduced in the 1992 Home Buyers' Plan have led financial consultants to suggest that households contribute to their RRSPs in order to access homeownership sooner. However, the effects of the Home Buyers' Plan on budget restrictions have not been studied and should be studied more closely.

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